Arizona Department of Water Resources
Hydrology Division

ARIZONA DEPARTMENT OF WATER RESOURCES

Prescott Active Management Area
2002-2003 Hydrologic Monitoring Report

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Final Report

by

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ADWR Water Management Division - Prescott AMA

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Introduction

This report presents hydrologic monitoring data and related information that has been compiled by the Arizona Department of Water Resources (ADWR) for the Prescott Active Management Area (AMA) during the period from January, 2002 through May, 2003. This year's report includes annual water level measurement data collected at 128 index well sites and compilations of surface water, precipitation, pumpage, recharge and water budget data.

This report is the third in a series of upgraded hydrologic monitoring reports that describe hydrologic data and conditions and related activities for the Prescott AMA. The report is the latest in a series of groundwater monitoring reports that were initiated, in part, to fulfill the groundwater monitoring requirements for the Prescott AMA that were established by the 1995 Assured Water Supply rules. This report may be downloaded as a PDF file from ADWR's website at: http://www.water.az.gov/.

Precipitation Data 2002

The 2002 precipitation data for the Prescott AMA confirm that the prolonged drought conditions affecting much of the western United States also persist within the Prescott AMA. Annual precipitation totals at Prescott and Chino Valley have been generally far below average since the late 1980's to early 1990's. The detrimental impacts of lower than average precipitation have been many. Surface runoff to rivers and streams has been significantly reduced and soil moisture is far below minimum levels to maintain acceptable forest health. Wild fire danger is extreme in forests and chaparral zones. Prolonged drought conditions have also reduced natural groundwater recharge to local and regional aquifer systems, a serious condition that has contributed significantly to declining water levels in some areas of the AMA where numerous domestic wells tap typically low-yielding bedrock formations.

Monthly total precipitation data for calendar year 2002 at the Prescott (Station 026796) and Chino Valley (Station 021654) precipitation stations are summarized in Tables 1 and 2. The data indicate that the annual precipitation at Prescott in 2002 was 7.17 inches or 38 percent of the long-term average, and the annual precipitation at Chino Valley was 5.32 inches or 45 percent of the long-term average.

Table 1. Monthly Precipitation in Calendar Year (2002) Prescott, Az. (Inches)

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
2002	.03	0.00	0.23	0.39	0.00	0.00	1.99	0.11	2.38	0.79	0.69	0.56	7.17
1898-2002 Mean	1.74	1.86	1.76	0.94	0.49	0.41	2.91	3.29	1.74	1.09	1.26	1.65	19.02

Source: www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azpres

Table 2. Monthly Precipitation in Calendar Year (2002) Chino Valley, Az. (Inches)

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
2002	0.14a	0.00a	0.57	0.39b	0.00	0.00	0.53a	0.00	2.35d	1.34e	0.00d	0.86f	5.32
1948-2002 Mean	0.95	0.95	0.98	0.56	0.38	0.34	1.89	2.05	1.31	0.84	0.64	0.91	11.79

Source: www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azchin

(some months during 2001 were missing one or more days of data, therefore monthly and annual total data are considered provisional)
a = 1 day missing, b = 2 days missing, c = 3 days missing, … z = 26 or more days missing

Actual total precipitation may exceed the indicated annual total due to missing days of data, official WRCC annual totals do not include months missing more than 5 days of data.

Surface Water Data 2002

Surface water flow data provide important information concerning the amount of flow in rivers, springs and streams. Many of the discharge measurements are direct indicators of the volume of groundwater that is discharged from the regional aquifer system to springs and river channels. Surface water data are also used to estimate the volume of water that is recharged to the aquifer system from streambed infiltration. Surface water data were collected between January 1, 2002 and December 31, 2002 from seven United States Geological Survey (USGS) stream gages located in or near the Prescott AMA. Surface water data are tabulated in Table 3. Daily discharge hydrographs for these gages are presented in Appendix A.

Comparisons of recent (calendar year 2002) discharge data were made to long-term annual mean discharge data and to median daily discharge data for the USGS gages with comparatively long periods of record. Comparisons were made for the gage on the Verde River near Paulden (09503700 – period of record 1963 to 2000), and for the gage on the Agua Fria River near Mayer (09512500 – period of record 1940 to 2000).

2002 Annual Mean Discharge – Verde River

The 2002 annual mean discharge at the USGS gage on the Verde River near Paulden (09503700) was 16,475 acre-feet per year, or about 54 percent of the long-term mean of 30,700 acre-feet per year (from 1963 to 2002) (USGS, 2003). The 2002 median daily discharge was 22 cubic feet per second (cfs), or 88 percent of the long-term median daily discharge of 25 cfs (USGS, 2003). The median daily discharge at the Paulden gage is generally indicative of the typical baseflow of the Verde River at that location. The baseflow is primarily sustained by a series of springs that discharge groundwater to the channel of the Verde River and to the channel of lower Granite Creek a few miles upstream from the gage.

2002 Annual Mean Discharge – Agua Fria River

The 2002 annual mean discharge at the USGS gage on the Agua Fria River near Mayer (09512500) was 6,443 acre-feet per year, or about 39 percent of the long-term mean of 16,480 acre-feet per year (USGS, 2003). The 2002 median daily discharge was about 0.9 cfs, or about 43 percent of the long-term median daily discharge of 2.1 cfs (USGS, 2003). Baseflow conditions begin on the Agua Fria River near Humboldt. Daily surface water discharge measurements for the Agua Fria River gage near Humboldt (09512450) primarily reflect groundwater discharge (baseflow); however, the gage discharge also reflects sporadic flows from infrequent precipitation/runoff events. During average to dry years some reaches of the Agua Fria River between Humboldt and the Mayer gage are dry (Wilson, 1988).

Table 3. **Summary of Provisional USGS Stream Gage Data for Selected Gages In and Near the Prescott AMA (01/01/2002 to 12/31/2002)**

Gage Description	Gage Number	Period of Record	2002 Mean Daily Discharge (cfs) (1)	Long-term Mean Daily Discharge (cfs) (2)	2002 Median Daily Discharge (cfs) (1)	Long-term Median Daily Discharge (cfs) (2)	2002 Minimum Daily Discharge (cfs) (1)	2002 Maximum Daily Discharge (cfs) (1)	2002 Annual Runoff (AF) (1)	Long-term Annual Runoff (AF) (2)
Del Rio Springs near Chino Valley	09502900	1996-2002	1.55	NA	1.5	NA	1.1	4.8	1,122	NA
Granite Creek Near Prescott	09503000	1932-1947 1994-2002	1.65	5.766	.22	.22	0	131	1,195	4,180
Granite Creek at Prescott	09502960	1994-2002	.84	3.845	.06	.20	0	53	608	2,790
Granite Creek below Watson Lake near Prescott	09503300	1999-2002	.12	.569	0	0	0	22	87	NA
Verde River near Paulden	09503700	1963-2002	22.76	42.38	22	25	20	247	16,475	30,700
Agua Fria River near Humboldt	09512450	2000-2002	4.63	NA	1.6	NA	0	687	3,349	NA
Agua Fria River near Mayer	09512500	1940-2002	8.9	22.75	.88	2.1	.23	826	6,443	16,480

Data Sources:
2002 provisional stream gage data and graphics downloaded from USGS website: http://water.usgs.gov/az/nwis/
Long-term stream gage data from USGS Water Resources Data Water Year 2002: (USGS, 2003)

Footnotes:
(1) 2002 figures based on discharge measurements collected from 01/01/2002 to 12/31/2002.
(2) Long-term figures based on discharge measurements collected during respective gage's period of record.
NA = Not available

Groundwater Data and Conditions 2002-2003

The measurement of water levels is an important data collection activity that provides information about changing groundwater storage conditions in the regional aquifer system. In general, rising water levels are indicators of increasing groundwater storage conditions, while declining water levels are indicators of decreasing groundwater storage. Groundwater conditions in the AMA's regional aquifer system were assessed by measuring the depth to water at 128 well sites located within or adjacent to the AMA (Figure 1). ADWR Field Services staff conducted the water level measurements during the period 02/19/2003 to 03/13/2003. The depths to water, water level changes, and water level elevations are summarized in Table 4.

Decreasing groundwater levels were observed at the majority of the 85 wells that were measured in both 2002 and 2003 that were used for statistical analysis (Table 4). For completeness, all data collected by the ADWR during 2003 have been presented in Table 4. However, not all wells that were measured in both 2002 and 2003 were used for the statistical analysis because of various non-standard well site conditions, such as cascading water, or recent or nearby pumping that could potentially bias a water level measurement. Although some of the well data were not used for the statistical analysis the data that were excluded were still often reflective of regional and local conditions.

Statistical analysis of the water level data indicates that 65 of the 85 wells (76.4 percent) that were measured in both 2002 and 2003 showed water level declines that ranged from –0.3 to –10.9 feet (Table 5). The mean decline was –2.5 feet and the median decline was –1.7 feet. The 2002 to 2003 mean annual decline rate of –2.5 feet per year was similar to longer-term decline data that indicate a mean annual water level decline rate of about –2.2 feet per year in 53 of the 60 wells (88.3 percent) that were measured in 1994 and 2003 (Table 4).

Water level declines were observed in most parts of the AMA. Declines ranged from less than -1 feet to over -8 feet in wells that were measured that penetrate the Upper Alluvial Unit (UAU) and Lower Volcanic Unit (LVU) aquifers located in the northwestern portion of the Little Chino (LIC) sub-basin near the Town of Chino Valley and Del Rio Springs (Townships 16 and 17 North, Range 2 West). Declines ranged from less than -1 foot to over -10 feet in wells that penetrate the UAU, LVU and/or bedrock in the Mint Wash and Williamson Valley Road areas north and east of Granite Mountain (western portion of Township 15 North, Range 2 West, and eastern portion of Township 15 North, Range 3 West). Declines ranged from less than -1 to –7 feet in wells that penetrate the UAU, LVU and/or bedrock in the Lonesome Valley, Indian Hills and Coyote Springs areas of the Little Chino sub-basin (Townships 15 and 16 North, Ranges 1 East and 1 West).

Water level declines in wells that are completed in the LVU in the northwest portion of the Upper Agua Fria (UAF) sub-basin in the Prescott Valley area (Township 14 North, Range 1 West, Section 10) were excluded from the statistical analysis due to nearby pumping conditions (Table 4). However, the annual declines in these wells were approximately –20 to –35 feet, based on a review of the hydrograph for piezometer well B(14-1) 10ADB1 PZ1 (see Figure 2). Water level declines ranged from less than -1 foot to about –11 feet in wells located in other parts of the Upper Agua Fria sub-basin (Townships 13 and 14 North, Ranges 1 East and 1 West).

Increasing groundwater levels were observed in 19 of the 85 wells (22.4 percent) that were used for statistical analysis. Water level increases ranged from +0.1 to +4.3 feet (Table 4). The mean increase was +1.4 feet and the median increase was +0.9 feet. The 2002 to 2003 mean annual rise rate of +1.4 feet was greater than the long-term rise rate of +0.4 feet per year that was observed in 7 of the 60 wells (11.7 percent) that were measured in 1994 and 2003 (Table 4).

Water level rises ranging from less than +1 foot to +3 feet were measured in wells that penetrate the UAU and undifferentiated volcanic rocks in the Upper Agua Fria sub-basin (Townships 13 and 14 North, Ranges 1 East and 1 West). The water level increased from less than 1 to 4 feet in two wells located near the Town of Chino Valley. The water level was observed to increase by +1 foot in one well in the Lonesome Valley area.

The water level remained unchanged in one well of the 85 wells (1.2 percent) that were used for statistical analysis from 2002 to 2003.

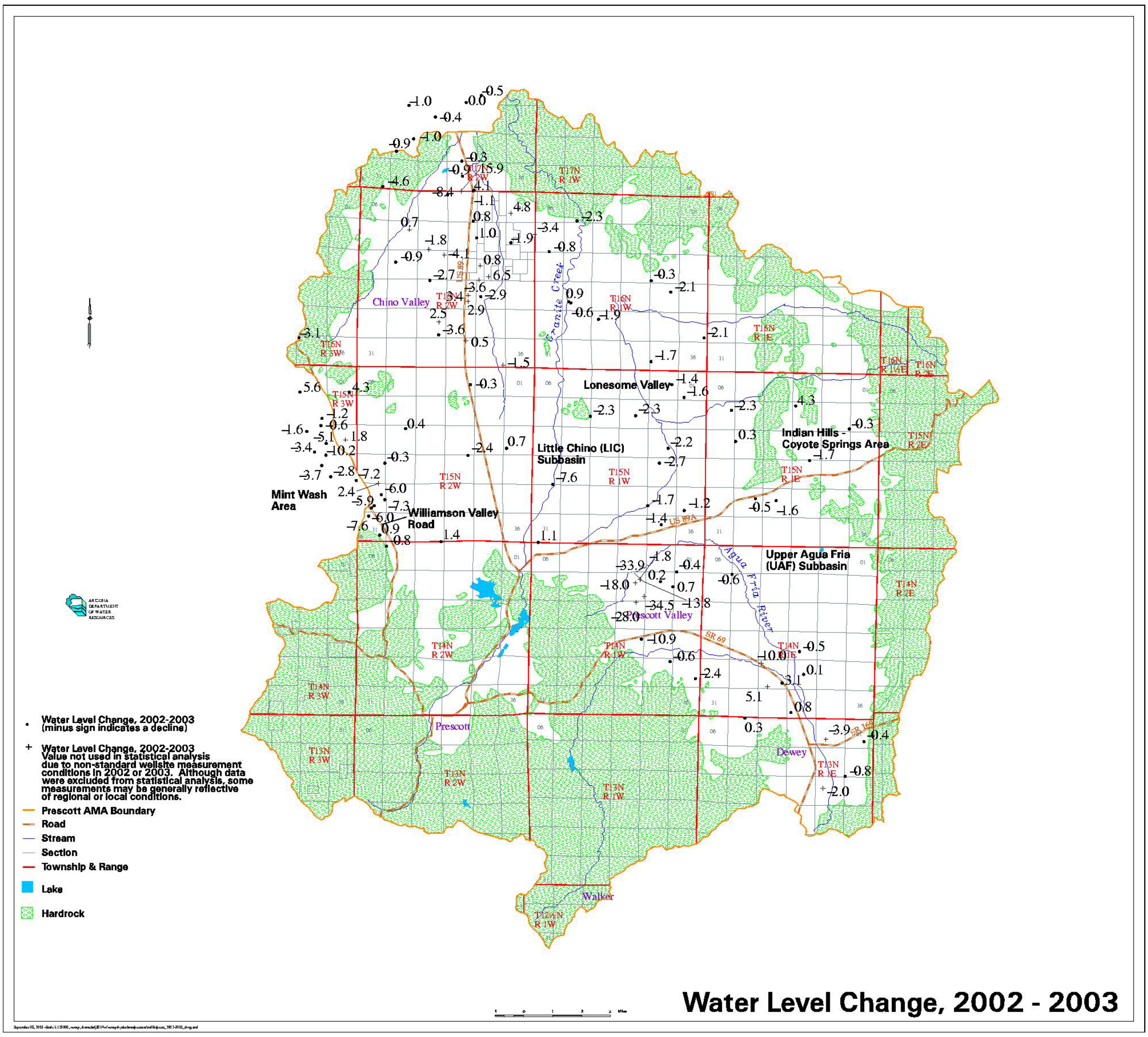

Figure 1. Water level changes in the Prescott AMA 2002 to 2003

Table 4. Summary of Water Level Data in the Prescott AMA and Vicinity (1994 to 2003)

(Figures rounded to nearest 0.1 foot)

SITE _ID	LOCAL_ID	1994 DTW	1999 DTW	2002 DTW	2002 REM	2003 DTW	2003 REM	94-03 WL CHANGE	99-03 WL CHANGE	02-03 WL CHANGE
343153112122901	A-13-01 01DCA	209.5	207.6	208.5		208.8		0.7	-1.2	-0.4
343157112135401	A-13-01 02CAD	86.4	82.9	81.1		85.0	P	1.4	-2.1	-3.9
343207112141501	A-13-01 03ADD					22.5				
343233112164901	A-13-01 05ABB		151.7	152.7		152.3			-0.6	0.3
343050112130901	A-13-01 12CCC	69.8	71.0	72.6		73.4		-3.6	-2.4	-0.8
343028112135701	A-13-01 14BDC1	28.7	30.5	129.6	P	51.5	R	-22.9	-21.0	78.1
343028112135702	A-13-01 14BDC2		51.6	34.9	S	36.9	T	-36.9	14.7	-2.0
343652112172101	A-14-01 08BBB	197.6	200.6	199.9		200.5		-2.9	0.1	-0.6
343508112160901	A-14-01 21BBA					54.6				
343453112160101	A-14-01 21BDB					40.7				
343442112144001	A-14-01 21DBA					29.4				
343434112145201	A-14-01 22CAD			76.4		76.9				-0.5
343428112123701	A-14-01 24DCB	306.3	301.0			301.7				
343353112144101	A-14-01 27ACC	48.3	43.8	42.6		42.5		5.8	1.3	0.1
343415112161401	A-14-01 28BBB	52.1	63.6	70.7	*	80.7		-28.6	-17.1	-10.0
343333112160201	A-14-01 28CDC		173.6	200.2	R	195.1	R		-21.5	5.1
343337112152901	A-14-01 28DAC2		86.1	102.8		99.7			-13.6	3.1
343244112150901	A-14-01 34CCA	66.7	73.9	77.3		76.5		-9.8	-2.6	0.8
344148112172701	A-15-01 07ADA	458.7	463.7	469.1		471.4		-12.7	-7.7	-2.3
344157112150701	A-15-01 10BBB2			134.7		130.4				4.3
344117112130901	A-15-01 11DDD	212.7	216.6	218.5		218.8		-6.1	-2.2	-0.3
344052112171701	A-15-01 17BCC	313.8	314.2	314.3		314.0		-0.2	0.2	0.3
344029112143501	A-15-01 22ABB	57.9	60.2	62.0		63.7		-5.8	-3.5	-1.7
343906112154701	A-15-01 28ACC	312.9	313.2	315.2		316.8		-3.9	-3.6	-1.6
343909112163201	A-15-01 29ADB			381.5		382.0				-0.5
343655112192201	B-14-01 01CCC		336.4	337.9		338.3			-1.9	-0.4
343634112205201	B-14-01 10ACA	477.8	583.6	662.5	S	680.5			-96.9	-18.0
343641112204202	B-14-01 10ADB1 PZ1		566.3	634.3	S	668.2	S		-101.9	-33.9
343641112204203	B-14-01 10ADB1 PZ2	331.5		322.7	S	324.5	S	7.0		-1.8
343640112204201	B-14-01 10ADB2			653.9	S	667.7	S			-13.8
343610112203201	B-14-01 10DDA	522.2	636.9	686.7	C	721.2	C	-199.0	-84.3	-34.5
343637112195701	B-14-01 11ACB	341.3	342.0	342.3		342.1		-0.8	-0.1	0.2
343628112193001	B-14-01 11DAA	327.5	328.5	330.5		329.8		-2.3	-1.3	0.7
343540112195701	B-14-01 14ACC	371.1	371.8			370.8		0.3		

SITE _ID	LOCAL_ID	1994 DTW	1999 DTW	2002 DTW	2002 REM	2003 DTW	2003 REM	94-03 WL CHANGE	99-03 WL CHANGE	02-03 WL CHANGE
343601112205301	B-14-01 15ABA	498.5	536.2	696.6	C	724.6	C	-226.1		-28.0
343453112203401	B-14-01 22ADA	325.9		331.7		342.6		-16.7		-10.9
343343112183801	B-14-01 25DAC	45.4	57.2	61.8		64.2		-18.8	-7.0	-2.4
343413112193401	B-14-01 26AAA	209.3	212.0	213.1		213.7		-4.4	-1.7	-0.6
343734112295501	B-14-02 05BBC		175.3	178.4		179.2			-3.9	-0.8
344208112191201	B-15-01 01CDC	366.8	370.3	375.8		377.4		-10.6	-7.1	-1.6
344233112193801	B-15-01 02ADC	323.1	327.0	331.2		332.6		-9.5	-5.6	-1.4
344134112223501	B-15-01 08DAA			377.5		379.8				-2.3
344136112205601	B-15-01 10DBB			309.7		312.0				-2.3
344038112194401	B-15-01 14DBD	323.5	328.8	334.2		336.4		-12.9	-7.6	-2.2
343930112235301	B-15-01 19DCD1	220.8	225.3	229.5		237.1		-16.3	-11.8	-7.6
343930112235601	B-15-01 19DCD2		370.5			380.0				
344011112200901	B-15-01 23BAD	328.7	336.3	341.8		344.5		-15.8	-8.2	-2.7
343847112190401	B-15-01 25CDB	292.8	296.0	298.0		299.2		-6.4	-3.2	-1.2
343854112202701	B-15-01 26CBC1		399.2	401.3		403.0			-3.8	-1.7
343746112242601	B-15-01 31CCD		341.7	349.8		348.7			-7.0	1.1
343820112195701	B-15-01 35ABD			381.5		382.9				-1.4
344227112265501	B-15-02 03DAB			342.0		342.3				-0.3
344038112253701	B-15-02 13CCB	363.7	365.1	368.7		368.0		-4.3	-2.9	0.7
344106112291501	B-15-02 17ABA	297.2	295.5	294.5		294.1		3.1	1.4	0.4
344005112300201	B-15-02 19ADA		334.4	335.4		335.7			-1.3	-0.3
343928112301401	B-15-02 19DDC		308.1	312.0	R	309.6			-1.5	2.4
342020112270101	B-15-02 22AAB			370.3		372.7				-2.4
343855112260601	B-15-02 26DBD2					312.6				
343905112301401	B-15-02 30ADC		119.5	137.7		143.7			-24.2	-6.0
343927112304701	B-15-02 30BAB		159.0			182.0				
343843112303101	B-15-02 30CDA		156.6	173.8		179.8			-23.2	-6.0
343858112300301	B-15-02 30DAA		144.7	161.2		168.5			-23.8	-7.3
343836112302401	B-15-02 30DCB		148.5	165.9		171.8			-23.3	-5.9
343829112303501	B-15-02 31BAD1		210.8	233.3		240.9			-30.1	-7.6
343754112301101	B-15-02 31DDB		208.3	213.7		212.8			-4.5	0.9
343755112291501	B-15-02 32ACC					274.7				
343715112275801	B-15-02 33DDC			428.4		427.0				1.4
344241112312201	B-15-03 01DCD	102.0	95.1	100.3		96.0		6.0	-0.9	4.3
344205112322901	B-15-03 02DCD					83.8				
344122112322201	B-15-03 11DDB		64.5	70.9		72.1			-7.6	-1.2
344108112311001	B-13-03 13AAA				O		O			
344147112313201	B-15-03 13ACC		217.4	221.4	R	219.6			-2.2	1.8
344025112310401	B-15-03 13DDD2					285.3				

SITE _ID	LOCAL_ID	1994 DTW	1999 DTW	2002 DTW	2002 REM	2003 DTW	2003 REM	94-03 WL CHANGE	99-03 WL CHANGE	02-03 WL CHANGE
344110112322201	B-15-03 14AAB			53.0		53.6				-0.6
344059112325401	B-15-03 14BAD			46.3		47.9				-1.6
344022112323501	B-15-03 14CDD			7.9		11.3				-3.4
344038112321101	B-15-03 14DAD			52.2		57.3				-5.1
344017112321101	B-15-03 23AAA			18.0		28.2				-10.2
343957112322001	B-15-03 23ADC			59.3		63.0				-3.7
343938112320101	B-15-03 24CCB			89.8		92.6				-2.8
343932112310401	B-15-03 24DDD			155.8		163.0				-7.2
344210112330901	B-15-03S02CCB			26.0		20.4				5.6
344727112231201	B-16-01 05CDD	174.9	180.9	186.6		188.9		-14.0	-8.0	-2.3
344628112174901	B-16-01 07CDD	158.4	163.9	171.9		172.7		-14.3	-8.8	-0.8
344540112202601	B-16-01 14CCC	284.7	290.3	297.8		298.1		-13.4	-7.8	-0.3
344501112232601	B-16-01 20CAC		222.2	225.9		226.5			-4.3	-0.6
344459112232601	B-16-01 20CBD1	45.2	44.4	51.4		50.5		-5.3	-6.1	0.9
344520112194301	B-16-01 23ACA			343.6		345.8				-2.1
344358112182901	B-16-01 25DDA	409.3	414.6	420.2		422.2		-12.9	-7.6	-2.1
344429112222001	B-16-01 28BCA	267.3	272.7	278.7		280.6		-13.3	-7.9	-1.9
344314112202401	B-16-01 35CBC	305.8	310.5	314.6		316.4		-10.6	-5.9	-1.7
344738112253301	B-16-02 01CBD	57.2	63.6	78.0	*	73.2		-16.0	-9.6	4.8
344809112275201	B-16-02 03BBB1	51.5	55.7	51.8		60.2		-8.7	-4.5	-8.4
344723112265701	B-16-02 03DDC4	37.6	46.7	55.9		55.1		-17.5	-8.4	0.8
344704112291601	B-16-02 08ACA	106.4	105.0	116.2	*	115.5		-9.2	-10.5	0.7
344629112283401	B-16-02 09CDC	166.8	175.8	185.1	*	186.9		-20.1	-11.1	-1.8
344653112264901	B-16-02 11CBB1	53.2	55.9	59.9		58.9		-5.7	-3.0	1.0
342658112244601	B-16-02 12ADD	110.2	115.6	120.2	*	123.6		-13.4	-8.0	-3.4
344645112253401	B-16-02 12CBD		76.9	85.1		87.0			-10.1	-1.9
344603112264001	B-16-02 14BCC	154.9	136.9	157.1	V	156.3	V	-1.4	-19.4	0.8
344540112264501	B-16-02 14CCC		173.1	183.4	*	187.0			-13.9	-3.6
344543112262201	B-16-02 14CDA	163.7	152.5	179.3	V	172.8	V	-9.1	-20.3	6.5
344613112271901	B-16-02 15ACB					174.7				
344622112275701	B-16-02 16AAD		155.3	163.9	*	168.0			-12.7	-4.1
344607112294301	B-16-02 17BDC	166.2	175.5	185.4		186.3		-20.1	-10.8	-0.9
344535112283001	B-16-02 21BAA2	218.6	225.6	236.7		239.4		-20.8	-13.8	-2.7
344507112270101	B-16-02 22DBA	192.4	201.8	215.4	V	212.0			-10.2	3.4
344458112270601	B-16-02 22DBD		212.2	225.9	*	223.0			-10.8	2.9
344507112263801	B-16-02 23CBA		167.6	176.8		179.7			-12.1	-2.9
344422112283201	B-16-02 28BDD	287.0	301.9	316.5	*	314.0		-27.0	-12.1	2.5
344357112280901	B-16-02 28DDC	288.1	295.7	306.4		310.0		-21.9	-14.3	-3.6
344347112310701	B-16-02 31BBB1	111.5				115.3		-3.8		

SITE _ID	LOCAL_ID	1994 DTW	1999 DTW	2002 DTW	2002 REM	2003 DTW	2003 REM	94-03 WL CHANGE	99-03 WL CHANGE	02-03 WL CHANGE
344314112285201	B-16-02 33CBC					354.0				
344347112271001	B-16-02 34ABA2	265.1	272.4	284.5	R	284.0		-18.9	-11.6	0.5
344304112254701	B-16-02 35DDD	297.0	302.5	310.4	*	311.9		-14.9	-9.4	-1.5
344348112331401	B-16-03 35BBB		115.0	123.3		126.4			-11.4	-3.1
345109112264401	B-17-02 14CCA			93.3		93.8				-0.5
345048112292201	B-17-02 20ABD			184.9		185.9				-1.0
345030112282301	B-17-02 21ACC			113.5		113.9				-0.4
345056112271601	B-17-02 22ABB			27.3		27.3				0.0
344950112291101	B-17-02 29ADC			231.8		232.8				-1.0
344928112294601	B-17-02 29CAC		456.0	458.5		459.4			-3.4	-0.9
344846112271401	B-17-02N34ACC	10.7	12.9	12.4		13.3		-2.6	-0.4	-0.9
344819112265701	B-17-02N34DDD1	4.6		20.7		21.8		-17.2	-21.8	-1.1
344819112265601	B-17-02N34DDD3	30.1	35.2	42.6		38.5		-8.4	-3.3	4.1
344821112301701	B-17-02S31ABA		498.8	496.4		501.0			-2.2	-4.6
344820112272701	B-17-02S34ABB			25.6	S	9.7		-9.7	-9.7	15.9
344917112273101	B-17-02W27DCC	9.2	11.6	14.1		14.4		-5.2	-2.8	-0.3

DTW = Depth to Water (in feet)

GWSI Remarks: C = cascading water
O = obstruction
P = pumping
R = recently pumped
S = nearby pumping
V= foreign material (oil)

Other Remarks: * = probable, but unobserved nearby pumping

Note (1) Wells with water level measurements annotated with remarks were not used in statistical analysis.

Note (2) 2003 water level measurements conducted between 2/19/2003 and 3/13/2003.

Table 5. Statistical Summary of Water Level Change Data in the Prescott AMA and Vicinity (1995 to 2003)

(Figures rounded to nearest 0.1 foot)

Period of Change →	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Number of Wells Used Analysis	16	17	44	43	87	92	84	85
Number of wells showing Increases in water levels	1	4	10	7	21	9	10	19
Sum of increase (feet)	+0.6	+18.0	+33.0	+39.5	+22.7	+35.7	+16.9	+31.0
Minimum increase (feet)	+0.6	+2.0	+0.1	+0.1	+0.1	+0.1	+0.2	+0.1
Maximum increase (feet)	+0.6	+7.0	+9.2	+16.3	+4.8	+15.0	+5.8	+4.3
Mean of increases (feet)*	+0.6	+4.5	+3.3	+5.6	+0.9	+4.0	+1.7	+1.6
Median of increases (feet)**	+0.6	+4.5	+1.5	+4.4	+1.2	+1.1	+0.5	+0.9
Number of wells showing Declines in water levels	15	10	34	35	63	82	73	65
Sum of declines (feet)	-54.3	-23.0	-71.4	-51.5	-188.2	-300.1	-288.8	-165.7
Minimum declines (feet)	-0.5	-1.0	-0.2	-0.1	-0.1	-0.1	-0.1	-0.3
Maximum declines (feet)	-13.4	-6.0	-12.6	-7.5	-19.6	-21.0	-42.3	-10.9
Mean of declines (feet)*	-3.6	-2.3	-2.1	-1.5	-3.0	-3.7	-4.0	-2.5
Median of declines (feet)**	-2.2	-1.5	-2.1	-1.2	-1.6	-2.25	-2.3	-1.7
Number of wells showing no Change in water levels	0	3	0	1	3	1	1	1

* The mean of increases or declines is the arithmetic average of each group of measurements (that is, the average change in water level for wells with measured increases in water level or the average change in water level for wells with measured decreases in water level). For example, the sum of all measured water level increases in the 19 wells that showed increases between 2002 and 2003 was +30.1 feet. The mean increase in water level, +1.6 feet, was calculated by dividing the sum of increases (+31.0 feet) by the number of measurements that showed increases (19).

** The median of increases or declines is a statistical measure of the central value of each group of measurements. Half of the measurements in each group are less than the median, and half of the measurements in each group are greater than the median. For example, the median decline in water level, -1.7 feet, equals the 33rd ranked well of the 65 total wells that showed rises between 2002 and 2003.

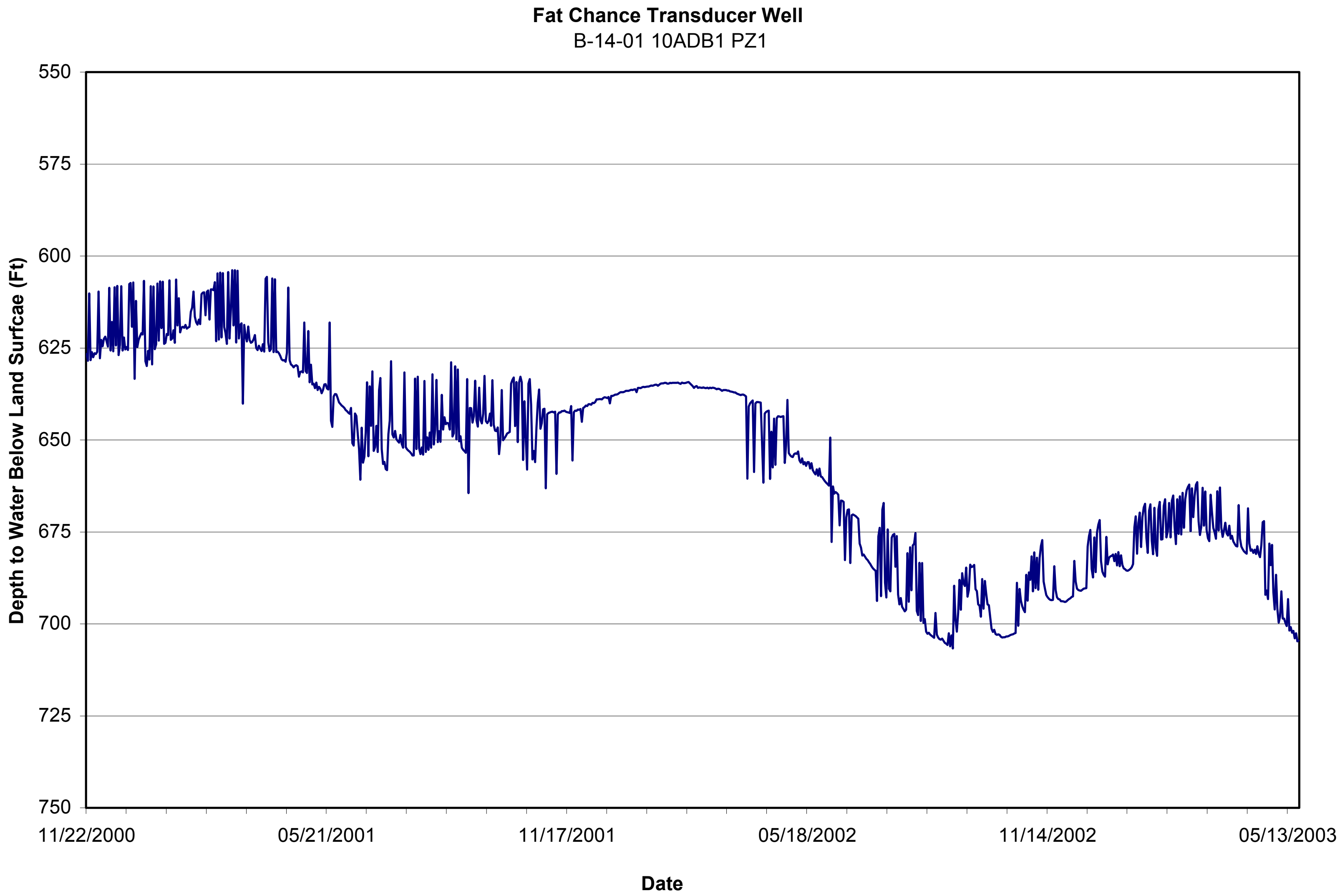

Figure 2. Hydrograph of Fat Chance Well –Prescott Valley Area

Groundwater Pumpage 2002

Groundwater pumpage represents the single largest component of outflow from the aquifer system in the Prescott AMA. Groundwater pumpage data provides important information that is used to assess the ever-growing demand on the aquifer system. Groundwater pumpage data are used to compile hydrologic water budgets, and supply well-specific pumpage inputs to groundwater flow models.

Annual groundwater pumpage totals are metered for each non-exempt well in the AMA, and are reported by the well owners to the ADWR. These data are tabulated in Table 6 for the period 1990 to 2002. The 2002 non-exempt well pumpage total in the Prescott AMA was 21,815 acre-feet (Table 6). The 2002 non-exempt pumpage was about 35 percent greater than the average annual non-exempt pumpage of 16,193 acre-feet per year during the last 13 years (Table 6).

Table 6. Reported Non-Exempt Well Pumpage in the Prescott AMA (1990-2002)

Year	Pumpage (Acre-feet)
1990	16,088
1991	13,780
1992	12,007
1993	15,279
1994	15,426
1995	15,011
1996	17,635
1997	17,132
1998	15,229
1999	15,642
2000	17,291
2001	18,171
2002	21,815
1990-2002 Total	210,506
1990-2002 Average	16,193

Exempt wells (registered wells that may not be equipped with a pump that can withdraw more than 35 gallons per minute), which are also commonly referred to as domestic wells, account for a substantial volume of groundwater pumpage in many parts of the AMA. Exempt wells often supply the water needs for residents that do not live within the service area of a local water provider. Large concentrations of exempt wells are found in the Chino Valley area, and in other areas that surround the regional aquifer system where wells are often drilled in comparatively thin, marginally productive alluvial deposits and/or volcanic rocks and bedrock (Mint Wash, Lonesome Valley, Coyote Springs, Dewey and Humboldt areas). Exempt well pumpage in the Prescott AMA was estimated at about 3,100 acre-feet per year (ADWR, 2002). The distribution of exempt well pumpage was estimated at 1,700 acre-feet per year for the regional groundwater basin area of the AMA and 1,400 acre-feet per year for the surrounding foothills and mountainous bedrock areas (ADWR, 2002).

2002 Conceptual Water Budget

A conceptual water budget prepared from the assembled 2002 pumpage, recharge and surface water discharge data is presented in Table 7. Estimates of long-term natural recharge that have been developed from the Prescott model update are used for that water budget component. The 2002 conceptual water budget for the Prescott AMA indicates that groundwater outflows exceeded inflows, resulting in a 15,450 acre-foot overdraft for the year.

Table 7. Conceptual Water Budget (2002) Prescott AMA

(Figures rounded to nearest 10 acre-feet)

Groundwater Inflows	2002 Volume (acre-feet)
Natural Recharge (1)	5,750
Incidental Recharge (2)	3,110
Artificial Recharge:	
(City of Prescott) (3)	1,760
(Prescott Valley) (4)	1,500
Total Inflows	**12,120**
Groundwater Outflows	
Groundwater Pumpage:	
Non-Exempt (5)	21,820
Exempt (6)	1,700
Groundwater Discharge:	
Underflow to Big Chino (7)	1,800
Del Rio Springs Discharge (8)	1,090
Agua Fria Baseflow near Humboldt (9)	1,160
Total Outflows	**27,570**
Inflow – Outflow = (Overdraft)	**15,450**

(1) Estimate for long-term average annual mountain front recharge (Nelson, 2002, pg. 10). Actual annual volumes may vary significantly from the long-term average.
(2) Estimated at 50% agricultural water use for 2001 (Corkhill, and Mason, 1995, pg. 58), (Nelson, 2002, pg. 10).
(3) Includes treated effluent and surface water. 2002 - City of Prescott Annual Underground Storage Facility Report-Schedule 71.
(4) Data provided by Neil Wadsworth (8/12/03) – Town of Prescott Valley. Includes effluent recharged in channel of Agua Fria River and in PV lakes.
(5) ADWR Registry of Groundwater Rights database.
(6) Estimated domestic and exempt well pumpage in Prescott AMA groundwater basin area only. 1,400 acre/feet per year of additional domestic well pumpage estimated for surrounding mountainous area (see pumpage section of this report for further details).
(7) ADWR model simulated underflow to Big Chino in 1999 (Nelson, 2002, pg. 14, Table 5).
(8) USGS 2002 annual discharge at Del Rio Springs gage (09502900). Note! Unquantified diversions of groundwater discharged from the cienega above the USGS Del Rio Springs gage are not reflected in the gage's annual total. Also a minor, unquantified volume of groundwater supports a small riparian area in the immediate area of the springs. For comparison purposes, the 1999 ADWR- model simulated groundwater discharge including undifferentiated ET component at Del Rio Springs = 1,800 AF/yr (Nelson, 2002, pg. 14, Table 5).
(9) USGS 2002 annual discharge at the Agua Fria gage near Humboldt (09512450). Annual discharge reduced to account for significant surface water runoff. For comparison purposes, the 1999 ADWR – model simulated groundwater discharge including a minor undifferentiated ET component to Agua Fria River near Humboldt = 1,400 AF/yr (Nelson, 2002, pg. 14, Table 5).

Summary and Conclusions

The 2002 precipitation data for the Prescott AMA confirm that the prolonged drought conditions affecting much of the western United States also persist within the Prescott AMA. In 2002, annual precipitation for Prescott was 7.17 inches or about 38 percent of the long-term average. Annual precipitation for Chino Valley was 5.32 inches in 2002, which was 45 percent of the long-term average.

Surface runoff to rivers and streams was significantly below normal for 2002. Surface flows gaged on the Verde River near Paulden totaled about 16,500 acre-feet for 2002, or about 54 percent of the long-term average. The median daily flow at Paulden which is indicative of the volume of groundwater discharged to the Verde from a system of headwater springs was 22 cubic feet per second or about 88 percent of the long-term median. Surface flows gaged on the Agua Fria River near Mayer totaled about 6,500 acre-feet for 2002, which is 39 percent of the long-term average. Median daily flow on the Agua Fria near Mayer was about 0.9 cubic feet per second or about 43 percent of the long-term median.

The long-term trend of water level decline indicates that groundwater storage depletion continued in most parts of the Prescott AMA during 2002. Water level declines averaged –2.5 feet per year in 65 of the 85 wells (about 76 percent) that were measured in both 2002 and 2003 and were used for statistical analysis. Significant declines averaging over –5 feet per year were observed in several domestic wells located in the Mint Wash and Williamson Valley Road areas north and east of Granite Mountain. Significant water level declines on the order of –20 to –35 feet per year were observed in several deep municipal wells that produce water from the volcanic aquifer system in the Prescott Valley area.

Non-exempt well pumpage totaled about 21,820 acre-feet for 2002. The 2002 non-exempt (domestic well) pumpage was about 35 percent greater than the 1990 to 2002 average. Groundwater pumpage from domestic wells in the AMA was estimated to be about 3,100 acre-feet per year during 2002. The distribution of exempt well pumpage was estimated at 1,700 acre-feet per year for the regional groundwater basin area of the AMA and 1,400 acre-feet per year for the surrounding foothills and mountainous bedrock areas.

A conceptual groundwater budget prepared using estimated inflow and outflow volumes indicates a groundwater overdraft of about 15,450 acre-feet occurred during calendar year 2002. The 2002 overdraft reflects the AMA's continued heavy reliance on non-renewable groundwater resources to sustain its current population and support future growth. Continued over reliance on mined groundwater will make it impossible for the Prescott AMA to achieve its long-term safe-yield goal without the most rigorous water management and development strategies that must include the importation of new water supplies in addition to enhanced water conservation programs and the maximization of effluent use and recharge.

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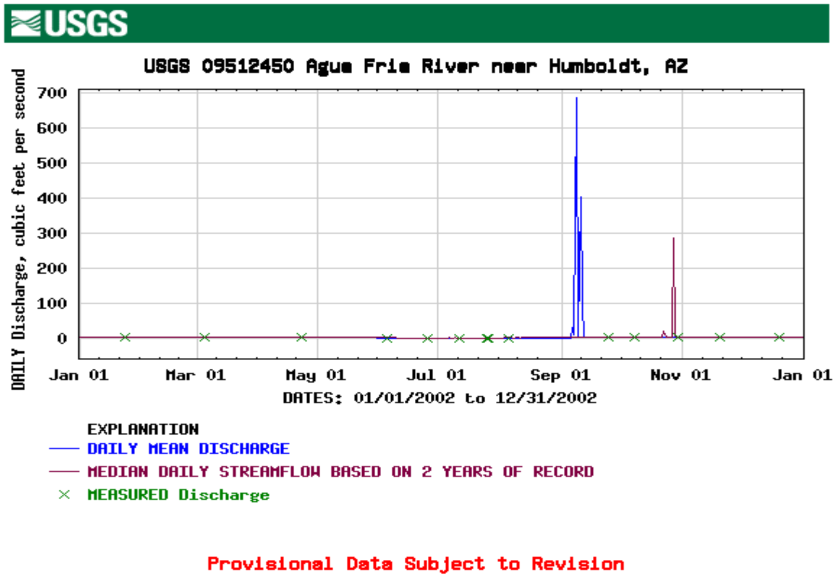
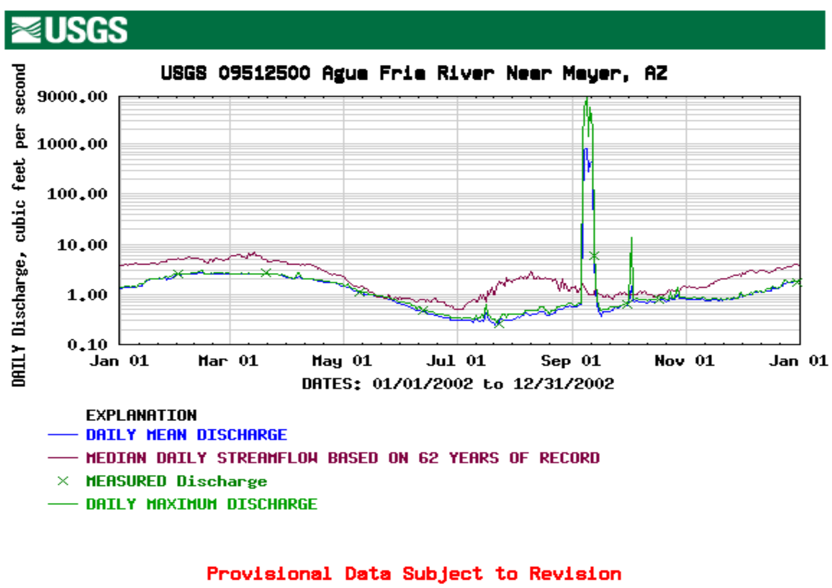
Appendix A Daily discharge hydrographs for selected USGS streamgages





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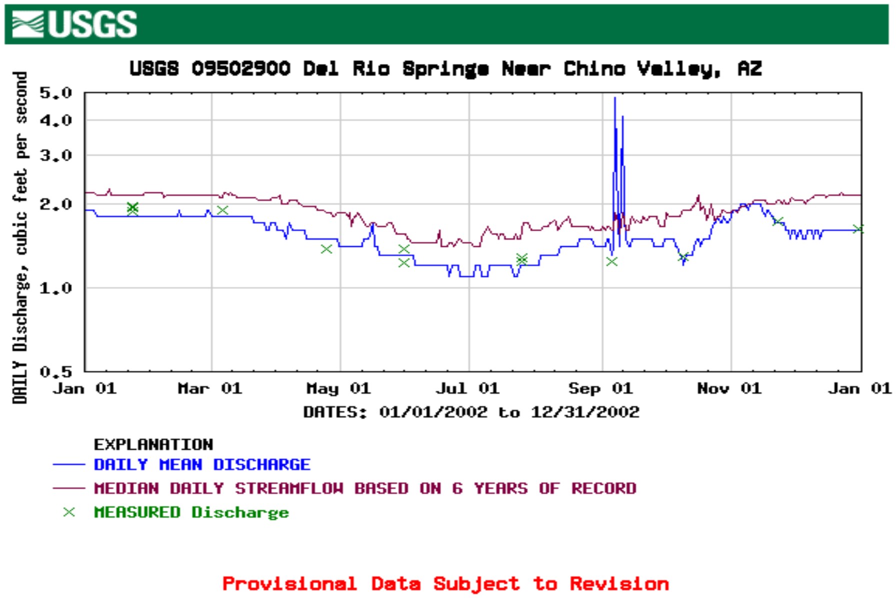

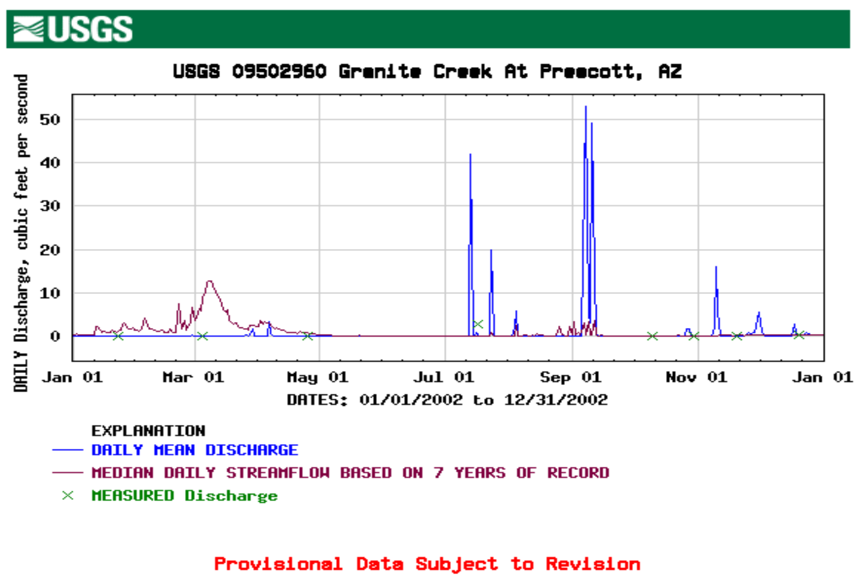

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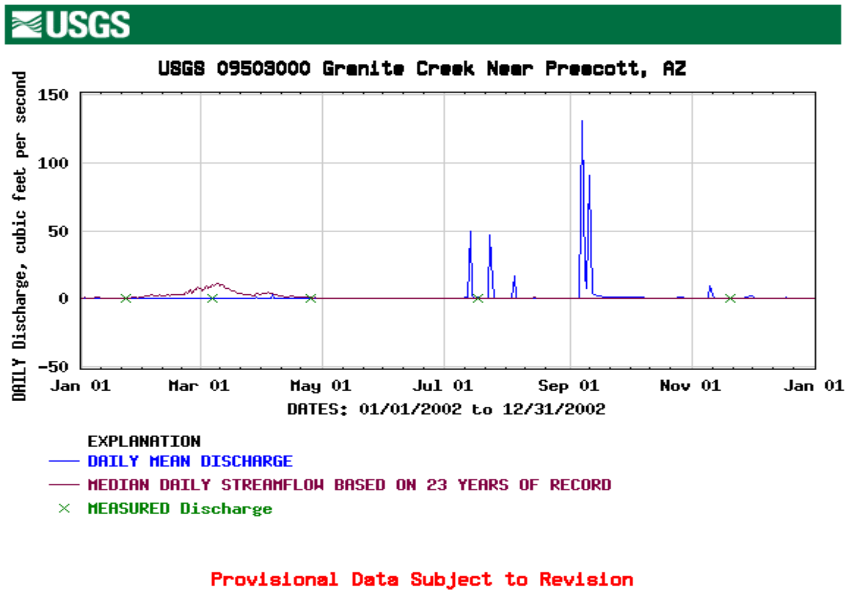

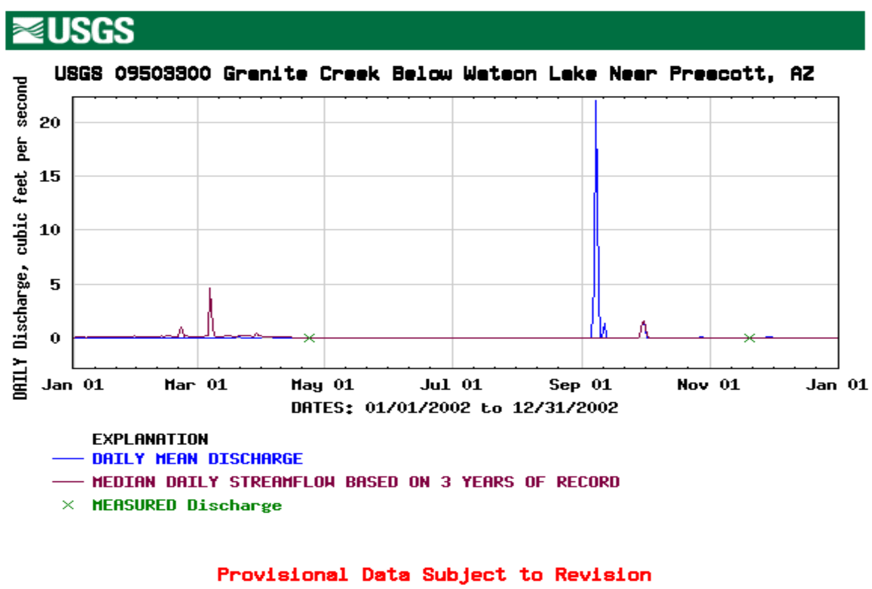

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